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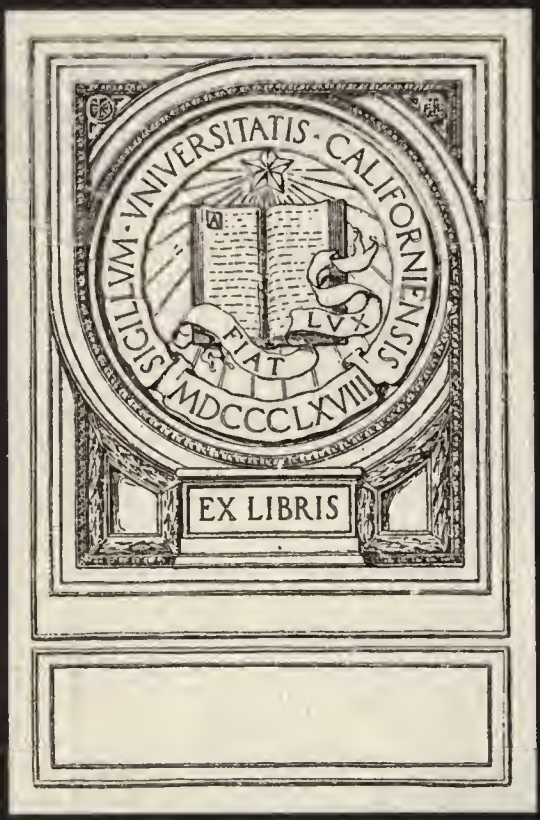
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A Treatise on

COST ACCOUNTING

as applied to

Coal Mining

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A Treatise on
COST ACCOUNTING
As Applied to
Coal Mining

UNIV. OF
CALIFORNIA

J. J. ROBY
EFFICIENCY ENGINEER
(Coal Mining Operations)
Leader-News Building
CLEVELAND

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Price $5.00

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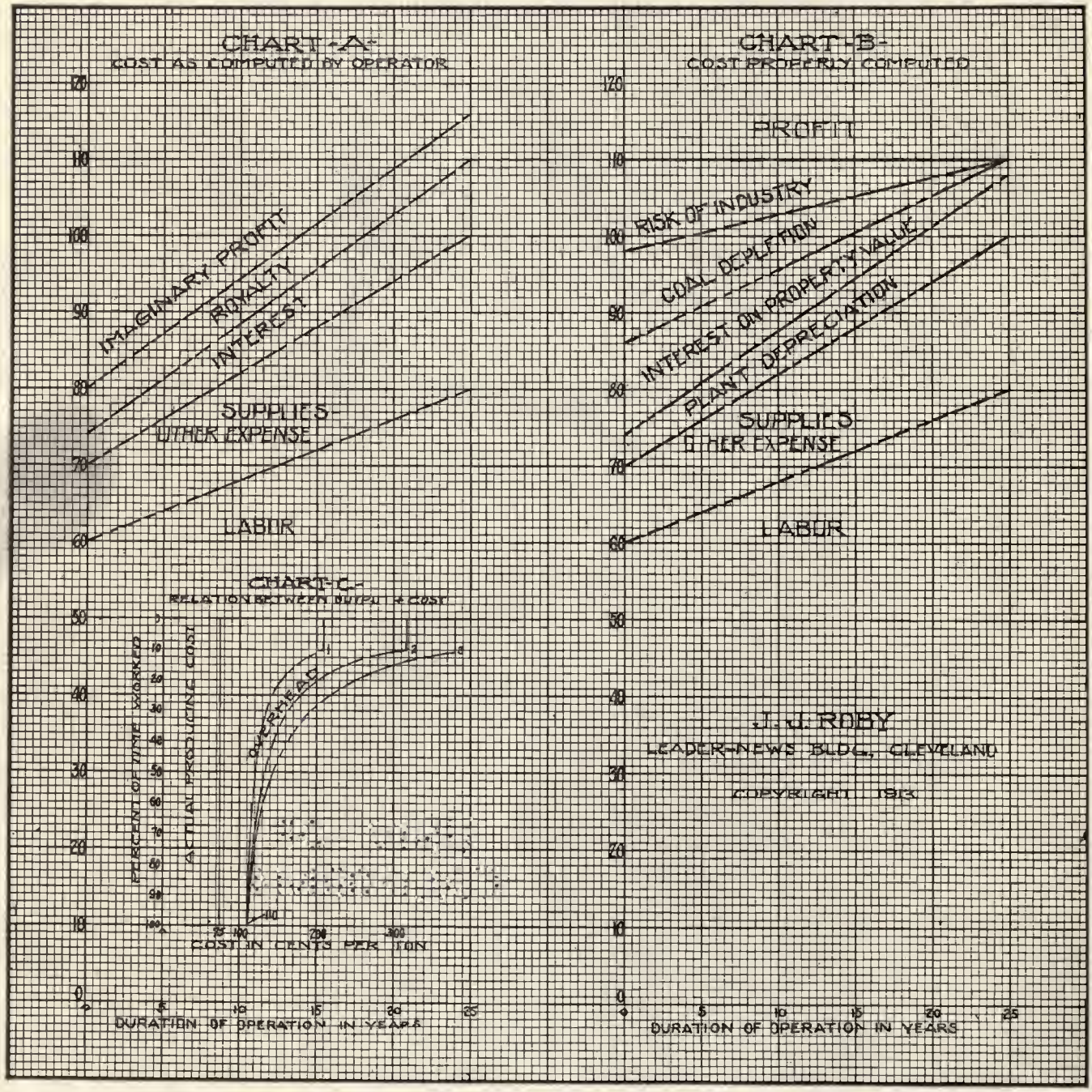
Charts showing comparison between proper method of computing cost and method commonly employed by operators



Note—Operators will find it an advantage to graphically show the results of their operation in the manner illustrated by Chart B, with the addition of a Selling Price line. To do so will prove a better guide than mere figures.

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Cost Accounting as applied to Coal Mining

Believing that investors in coal property suffer serious losses from the operation of mines through lack of a proper and uniform method of computing the cost of production, I submit this work with the view that it will enable Coal Operators to accurately determine the cost of producing a ton of coal and the proper selling price thereof.

In dealing with the subject, I have considered that the Investor, or Coal Operator, is entitled to charge a price for his product that will cover all cost, including interest on the investment, the risks of the industry, the return of the investment during the life of the operation, and a profit equal to that realized in other industries.

Giving due consideration to the public, or buyer, (always an interested party in any question), the fairness of the suggestion may be seen by reference to the decision of the late Judge Tayler in the recent Street Railway controversy in the city of Cleveland, which was, substantially and briefly, that the owner was entitled to charge, for its service, rates that would pay all cost of operation, maintenance and renewals to keep the property intact, and 6% interest on the property value which is increased by the cost of extensions and additions. And further, that, should the city demand municipal ownership, the owner should be paid the property value plus 10 per cent.

In a measure, these principles will apply to the coal business, but we must add annually, a royalty for coal depletion and a depreciation on plant and equipment, which cannot be kept intact, because there is not the permanency of a street railroad, and also an amount equal to 6% of the property value for the hazard of mining.

Our laws are intended to prohibit combinations or agreements that have as their object extortion from the buyer, but there are no laws to prohibit the selling of a commodity at less than cost, nor to prohibit a producer from demanding for his product its full cost plus a reasonable profit. Our lawmakers must have assumed that every prudent business man would, at least, demand a price that would pay the cost of operation, interest on the investment, and return the investment with a profit, and that a provision that no extortion occur would meet all requirements; but there are those who cripple their own resources by selling at less than cost, if the cost be properly computed, and entail a loss upon others by their ill advised act. The laws protect the consumer, but they do not protect the producer against the folly of competitors.

It is not the purpose of this effort to discuss the legal phase of the question but to show how Coal Operators may determine the cost of producing a ton of coal and a selling price that will give them a reasonable profit on their investment and assure its return.

The Coal Operator, especially the one who begins an operation without previous experience in coal production, in the course of time, frequently sees his margins narrowing, and he is helpless to avert the loss which must, inevitably, follow. The loss thus sustained may in part be the result of his own improper method of accounting, or it may be wholly the result of the improper accounting of a few of his immediate competitors.

The coal business, by the very nature of things, carries certain hazards not present in other lines of business, and the coal investor, for this reason, is entitled to a greater margin of profit than one engaged in a less hazardous business, but there are few operators who take this feature into account. These hazards may be enumerated as unexpectedly meeting with faults, gas, water, creep, and accidents.

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Coal operators generally, no matter how carefully they have guarded against errors in cost accounting, have overlooked one fact, which, in itself, has prevented correct determination of cost. When the operator acquires a tract of coal sufficient for a substantial operation it costs him a definite amount of money, and he also closely estimates the number of tons of coal that his purchase will ultimately yield. He begins to operate in the coal located nearest his openings and, as the coal is mined, he must, from day to day, go farther and farther into the seam, until he reaches the end, or limit, of his holdings, which requires longer hauls and increased cost of operation and maintenance. It requires double the amount of main track, double the amount of maintenance, and double the amount of power to haul coal one mile as is required to haul coal one-half mile, and the cost of ventilation increases even more rapidly. Those who charge as a part of their cost of production, a royalty for coal depletion, figure from the standpoint of average value per ton in the ground, but they have overlooked the fact that the coal nearest their operation, and first mined, has the greatest value, while that farthest removed from the operation has the least value. The result is that those who have charged a flat royalty as a part of their cost have not charged a proper royalty. To obtain a more uniform cost, the royalty, when the recoverable coal is sufficient to operate for 25 years, should be double the average value, at first, and gradually reduced to nothing by the time the length of haul becomes prohibitive. Unless this be done the operator exhausts his most valuable coal and sells it to the consumer at a price which will not cover his cost of mining at the limit of his territory. In other words, the operator who does not take this into account is misled, believing that he is making money, when, as a matter of fact, he is not, just as the horsedealer thinks he is making money when he buys ten horses at $100 each, ten at $150 each, and ten at $200 each (his average value being $150 each), and sells ten of his best horses at $175 each. He might figure that he has made $25 on each horse in the sale, but, as a matter of fact, he has lost $25 on each horse sold.

Unmined coal in the earth may be properly considered as raw material. The manufacturer, who conducts a manufacturing business, procures his raw material from time to time from various parts of the country in such quantities as he demands and, when the cost thereof fluctuates, he is enabled to make a proportionate charge therefor, into the cost of the finished product. If the supply runs short from one source he obtains it from another. His real estate and buildings, once a location is made, assure him permanency of location. Such real estate does not depreciate in value and his depreciation on buildings is minimized by their assured use for the full term of their life. The Coal Operator, on the other hand, has to meet an entirely different condition. To engage in the coal mining business the Operator must acquire, outright, by purchase or lease, title to an acreage of coal sufficient to warrant the development of a mine. His source of raw material, or coal, to be operated at that mine, is wholly restricted to the coal accessible to such operation and, by reason thereof, his investment in raw material must be sufficient to operate a great number of years which, at once, creates a heavy carrying charge. He must invest in real estate upon which to locate his mine and pay for such real estate a price much higher than the average value of farm acreage in order to induce the owners to part with portions of their land. When his coal is exhausted and his mine is abandoned, the real estate, for which he paid a high price, has depreciated to a very low value. Unless he acquires sufficient coal accessible to his operation to assure continuance of mining during a period equal to the life of the buildings and equipment which he, by necessity, must provide, these have a correspondingly shorter period of utility and a correspondingly greater depreciation.

Some operators disregard the item of depreciation, giving no consideration to the period of utility of their plant and equipment, but it is apparent that, with a quantity of coal sufficient to operate 20 years, at the end of which time the plant must be abandoned, the minimum depreciation cannot be less than 5% per annum, but, if the quantity of coal be sufficient to operate 25 years, the minimum depreciation would be but 4% per annum. On the other hand, if there is only sufficient coal to operate 10 years, the minimum depreciation should not be less than 10%. From this, it will be seen that the minimum depreciation is influenced directly by the duration of the operation. Some operators even neglect a charge for royalty, or coal depletion, while others make such a charge determined arbitrarily, without any definite rule for arriving at the proper charge. Some operators charge interest on their investment as a part of the cost of production while others simply charge actual interest paid on securities.

The Coal Operator, who disregards interest on investment, plant depreciation, and coal depletion, charging as cost his actual outlay, usually deceives himself. When he adds to his actual cost an imaginary profit that will satisfy him and sells his product at that price, he not only deceives himself, but he does an injustice to his neighbors by establishing a price for a product which will not cover the cost of production, if properly calculated, and he brings loss to himself and his associates.

Another condition that misleads most coal operators, and one that is frequently disregarded, is the changing value of coal property. No well defined rules have ever been established for determining the value of a coal property and the absence of such rules makes correct accounting more difficult. Some operators, when the results of operation prove unsatisfactory avoid showing a loss by arbitrarily showing an increase in the value. This is all wrong. The value of a property is just what it is in comparison with other like properties, no more and no less, although each property has certain physical conditions which must be considered in determining its value. A property having good physical conditions is more valuable than one with poor physical conditions, because the cost of operation at the latter must, naturally, be greater, which reduces the value. A property becomes more valuable from a permanent increase in net earnings, when the increased earnings go to surplus, or profit and, to this extent, a property can be made more valuable, but one cannot arbitrarily add to its value. If one attempts to obscure a loss by arbitrarily increasing values with a view of selling the property and the losses, at par, he will, most likely, be disappointed.

Each individual property may have a different value per ton, as compared with other properties, but the average selling price of coal of similar grade in any one district, or region, largely determines the base value of coal acreage in that district; and the operator who does not give consideration to this fact and sells coal at a price, underbidding his competitors, without taking into account the cost, is directly responsible for depressing coal values in that district generally.

Investors are more frequently securing the opinion of engineers and expert accountants, before investing, and the methods employed by them in determining values are being reduced to a science. The progressive operator is more frequently employing engineers and accountants to check up his conditions and values, to recommend betterments, and to show the proper values as a basis for proper accounting. This is most essential and should be the first step toward establishing a uniform system of computing costs.

We frequently hear Coal Operators complain of fluctuations and lack of stability in the coal business. There is no business entirely free from fluctuations in demand for the product, but there is more lack of stability in the coal business, than in any other, because many Coal Operators act independently, and, in various other ways, tend to destroy, rather than to create, the co-operation which brings effective results.

The successful business man bases his selling price upon his cost of production, allowing a fair margin for profit, and he always charges as a part of his cost the value of his raw material, interest on his investment, and depreciation on his plant.

It is not my purpose to make this a treatise on bookkeeping but to indicate to the operator and his bookkeeper how to avoid loss through errors in cost accounting.

There is no other commodity so essential to our industrial and personal welfare as coal, but we have no line of business in which the methods of cost accounting vary so greatly as in the coal business.

The coal business, with reference to cost accounting, is very different from any other line of business, and the methods of accounting employed in other lines of business, when applied to the coal business, greatly mislead the Coal Operator.

When a coal property is acquired, the logical order of accounting is as follows:

A company is incorporated and organized, and the expense is a proper charge to property account and should be treated as an asset.

The cost of coal rights and necessary surface land should be charged to property account.

The cost of development and equipment, including engineering, labor, machinery, material, interest on actual investment and capital, taxes, insurance, and cost of administration (until the mine is developed to the degree that the mine produces room, or wide, coal over the permanent tipple), less income for the product during such development, should be charged to property account and treated as an asset.

The mine should then be put on an operating basis, and the cost of operation should consist of labor and supplies in connection with operation and maintenance, interest on investment and capital, a charge for risk of the industry equal to the interest charge, a charge for coal depletion, a charge for plant depreciation, and the cost of administration and general expense.

No mention need be made of the usual accounts of Property and Plant, Cash, Bills Receivable, Accounts Receivable, Inventory, Stock Subscription, Bonds, Bills Payable, Accounts Payable, Dividends, Capital Stock, and Profit and Loss, as these accounts should be entirely understood by the bookkeeper.

Some operators purchase a large tract of coal land, only a part of which can be operated from any one operation. Only the cost of that part of the coal rights which will be mined by such single operation should be taken into the operating account, and the rights requiring an additional operation should be carried as a separate investment, apart from the operating accounts; and such separate investment should be carried in an account termed "Inoperative Coal Rights" which should be charged with the cost of such rights, interest on the cost, taxes, and the cost of administration, until the investment becomes operative.

Dwellings and stores should be carried in a separate account, apart from the coal operation, as the investment has an income of its own and, therefore, should be accounted for separately. The cost of dwellings and store should be charged to "Dwellings and Store" account which should be credited with depreciation. The interest, taxes, insurance, and cost of maintenance of dwellings and store should be charged to "Dwellings and Store Expense" account which should be credited with rentals.

Investment in physical property and operating costs should be subdivided into the following accounts

PHYSICAL PROPERTY:

Real Estate, Mining Rights, Surveys and Maps, General Office, Organization, Financing, Railroad, Openings and Hoists, Tipple Equipment, Power Plant, Shop and Equipment, Ventilating Equipment, Mine Office, Storehouse, Stable and Live Stock, Mine Tracks, Electric Wiring, Lighting Equipment, Mine Locomotives, Mining Machines, Mine Cars, Wagons and Tools, Telephone Equipment, Safety Appliances, Lubricating Equipment, Steel Roof Supports, Mine Pumps and Pipe, and Stone and Dirt Equipment.

OPERATING ACCOUNTS

Mining, Narrow Work, Faults, Hauling, Superintending, Surveying, Railroad Expense, Opening and Hoist Expense, Tipple Expense, Power Expense, Shop Expense, Ventilating Expense, Mine Office Expense, Storehouse Expense, Stable Expense, Mine Track Expense, Electric Wiring Expense, Lighting Expense, Mine Locomotive Expense, Mining Machine Expense, Mine Car Expense, Wagon and Tool Expense, Telephone Expense, Safety Expense, Lubricating Expense, Timbering Expense, Drainage Expense, and Stone and Dirt Expense.

The operator will find it an advantage to thus subdivide Property Account and to carry the above subdivisions for operating costs, as it will enable him to charge his investment in such a manner as to facilitate the computing of depreciation, and arrive at the actual cost of operation for each division.

General Expense should be subdivided into the following accounts:

Salaries of Officers, Salaries of Salesmen, Salaries of Clerks, Traveling Expense, General Office Expense, Telephone and Telegraph, Legal Expense, Taxes, Insurance, Interest and Discount, Personal Injury, Plant Depreciation, Investment and Capital Interest, Coal Depletion, and Risk of Industry.

Personal Injury should be charged with Liability Insurance, or, in the event such insurance is not carried, an amount equal to the cost of same, at customary rates.

Plant Depreciation, and Coal Depletion charges are the most difficult of determination, but, to those operators who desire to avoid loss from neglect to compute plant depreciation and coal depletion, as a part of their cost, the accompanying schedule of plant depreciation and example indicating method of computing coal depletion will serve their purpose, the rates for depreciation as shown being based

upon ordinary use of plant and equipment for natural life. When the probable life of the operation is less than the natural life of the property receiving consideration, the rate must be computed on the term basis and increased proportionately.

In order to make the application of the schedule clear, I have shown under remarks opposite each subdivision of property, A, B, C, D, or E, as reference, to facilitate finding the term in years.

When the rate of depreciation is not given, or when the probable life of the operation is insufficient to return the remainder of the value, at the rate given, the depreciation rate, for terms A and D, should be determined by dividing 100 by the term in years, which in turn, may be determined by dividing the whole number of recoverable tons of coal by 200 times the average daily production.

The rate of royalty, term B, for fee coal, when sufficient to operate 25 years, may be determined, for the first year, by dividing twice the coal value by the whole number of recoverable tons, which rate should be gradually reduced each year, proportionately, as shown by the example previously referred to.

The royalty charge, term C, for leased coal, may be determined by valuing the coal as if owned in fee, regardless of the rate per ton provided by the lease and arrive at the rate, for the first year, as in the case of B. The rate for the first year should be reduced each year the same as with fee coal.

The rate for depreciating the cost of Financing may be found by dividing 100 by the number of years the securities run, from date of issue to date of retirement.

By reference to the example before mentioned, it will be seen that, during the first year, dating from the time that development is begun, there is no depletion charge, because the mine is being developed and the cost of production is necessarily high. It will also be noticed that the depletion amounting to $48,000, or 12 cents per ton on 400,000 tons, for the second period is reduced to $46,000, or 11.5 cents, for the third year, or period, during which 400,000 tons are produced (which is the proper term to use rather than the year), with a like reduction for each successive period. This reduction of one half cent per ton, to be made after each 400,000 tons be produced, will, in part, compensate for the increased cost of haul and maintenance due to mining the 400,000 tons of nearest coal.

By assuming that one half cent properly compensates, so far as coal depletion charge should contribute, for increased haul and maintenance and that only 4,000,000 tons of recoverable coal be accessible, it is evident that, with the same capacity, the mine will be exhausted in eleven periods, including the one year allowed for development, 400,000 tons being mined in each of the last ten. In this instance, it will be noticed that the coal depletion, calculated as before, would amount to $390,000, which gives the 4,000,000 tons an average value of 9.75 cents per ton.

It is now apparent that an operation having 10,000,000 tons recoverable coal, which cannot earn sufficient to cover a royalty charge of more than 6 cents, for the first operating period, ceases to have value after the twelfth operating period, and operation after that period has passed must be at a loss, unless the operator increases the earnings. The coal depletion will have amounted to but $156,000 which at once gives the coal a value of but 1.56 cents per ton for the total available coal, or 3.25 cents per ton on 4,800,000 tons minable coal.

It is impossible to illustrate every condition, but the conditions cited will make clear the fact that the value of the coal, regardless of what may be paid for it, is determined by the net earnings, out of which must be paid plant depreciation, royalty, investment and capital interest, risk of industry and a reasonable profit.

Out of "Investment and Capital Interest" charge should be paid the interest on borrowed capital and, out of coal depletion and plant depreciation charges, replacement expenditures should be paid.

The charge for risk of the industry should be treated as a fund out of which should be paid expense incurred as a result of encountering the unexpected conditions enumerated, including personal injury expense not covered by liability insurance.

It is to be understood that all cost of original and additional property, and the replacement of equipment, should be charged to property, and that labor, supplies, and expense in connection with operation and maintenance are to be charged to operating. Plant Depreciation and Coal Depletion charged to those accounts should be credited to property.

Ineome should be subdivided into the following accounts:

Coal Salcs, and "Reeeipts from other Sourees."

Material and Supplies placed in the storehouse as a reserve for emergency or future use should be eharged to "Material and Supply" Aeeount, whieh should bc credited as the material and supplics are used and eharged to the proper Property or Operating aecounts, from thc storekeeper's report.

Powder, Miner's Oil, and Miner's Supplies should be charged to "Miner's Supply" Account, which should be credited with the ineome from same.

The storekceper's serviees should be eharged to Storehousc Expense and Miners' Supply in the proper proportions.

Freight and Express eharges and eartage, or teaming, should be eharged to the same accounts as material in conneetion with whieh these charges originated, and, when the material is plaeed in the storehouse and eharged to "Matcrial and Supply," the ehargc, and credit upon use of the material, must ineludc Freight, Express, and Cartage.

Cost aeeounting should not only enable the operator to aecurately determine the cost of conducting his business, but it should be accomplished in sueh a way as to facilitate eomparison, which is practieally impossible except as between rcsults arrived at by uniform methods.

The accompanying eharts illustrate the differenee between thc methods eommonly employed by operators and the one herein provided.

Thcse charts have been made on the assumption that a new operation has a capacity of 2,000 tons per day, that there is suffieient coal, with the most favorable eonditions, acccssible to thc operation to operate thc mine 200 days pcr year for a period of 25 years, that therc are 10,000,000 tons of coal in the ground having a value of 6c pcr ton, or $600,000, that the investment in the plant, exelusive of dwellings and storc, is $200,000, that the depreciation at proper rates will amount to 4c per ton on 400,000 tons annual production, or $16,000, at the beginning, or an average of 8%, that the interest in the beginning will amount to $48,000, cqual to 12 eents per ton, or 6% on $800,000, that thc eoal depletion chargc of 12 cents per ton would obtain at first and, that a charge equal to the interest should be made to covcr the risk of the industry, beeause this risk cannot be conservately estimated at less than the interest on the investment.

Chart A is designed to show how operators commonly compute their eost. It is assumed that, at the beginning, the labor eost is 60, and supplies and other expense 10, interest on borrowed capital, amounting to $266,667 (whieh does not include owner's investment) 4, uniform royalty 6, all of which total 80.

The opcrator may consider that if hc can sell coal at 90 cents hc is making all his cost, including interest and royalty, and an imaginary profit of 10 eents, but he has made no eharge for plant depreeiation, no eharge for interest on his own investment, and has given no eonsideration to risk of the industry.

As the workings advance and the mine beeomes older, the eost for labor increascs from 60 to 80, supplies and other expense from 10 to 20, and the interest on borrowed money incrcases from 4 to 10, beeause the operator has not eharged suffieient for his coal to enable him to pay his cost, and he has increased his loans. It will be seen that, at a 90 cent selling price, after the mine has operated 7 years, the imaginary profit is entirely wiped out, and the operator is not able to make his uniform royalty. At the end of 11 years he is not able to eharge a royalty and is not able to pay the full amount of interest. At the end of 25 years hc has no profit at a selling price under $1.16.

The operator who figures his eost by this method deceives himself. If hc sells his coal at 98 cents per ton, he will apparently make a profit of 18 eents at the beginning, which gradually reduces year by year for 12½ years, when apparent profit eeases, and he runs into a loss, whieh gradually inereases, until at the end of the 25 year period, if hc still scllls eoal at 98 eents per ton, his loss is 18 cents per ton, or equal to his apparent profit at the beginning. He has not returncd any part of his investment exeept what royalty he received in the earlier period of the operation.

Chart B is designed to show how the operator should compute his eost to safeguard his investment. Labor, supplics, and other expenses inerease as beforc. Hc should eharge plant dcpreciation, which by the nature of things, is less per ton in the beginning and gradually incrcases throughout thc period

as he is required to add additional equipment and take care of the increased hauls and ventilation. It is assumed that depreciation increases from 4, at the beginning, to 8, at the end.

Interest should be charged on the full property value, which is 12 at first, gradually reducing to 2 at the end, as the investment is returned through royalty and plant depreciation charges. Royalty, or coal depletion, should be double the average value of the coal, gradually reducing throughout the period, from 12 at the beginning, to nothing at the end. There are certain risks, which cannot be estimated at less than the interest on the unretired investment, being greatest in the beginning, because the investment is largest. This, also, should be reduced gradually to nothing, at the end of the period.

It will be seen that the real cost of producing a ton of coal, under conditions previously mentioned, is $1.10 at the beginning and throughout the period, except as such cost may be influenced by increase or decrease of labor scale. From this it is apparent that no real profit is made except by realizing a selling price in excess of $1.10 per ton.

It is also apparent that, if the average value of this coal is 6c per ton and the operator desires to make a net profit throughout the period of operation, equal to $24,000, or 3% on his original investment of $800,000, over and above the cost which is $1.10 per ton, he must not sell the product for less than $1.16 per ton.

The selling price of $1.16 happens to equal, exactly, the cost at the end of the operation, as shown by Chart A. If the operator, who has been computing his cost as shown by Chart A, will draw a horizontal line on a scale of 116 and another line on a scale representing the price at which he has been selling coal, he will, at once, see how much he has been losing by his method of accounting.

Operators are frequently confused when considering costs, one claiming that the actual outlay for labor and supplies constitutes the operating cost, the actual outlay for salaries, legal, general office, and traveling expense, taxes, insurance, and personal injury constitutes General Expense, and interest on borrowed capital together with sinking fund requirements constitutes overhead, while another treats these various items of expense in various and different ways so that, when an operator says his operating cost is 70 cents, another operator does not understand just what he means, because the latter uses a different method of computation.

It would be simpler and more easily understood to consider the actual cost of operation, including repairs (not renewals or replacements), salaries, legal, general office, and traveling expense, taxes, insurance, and personal injury as Constituting Primary Cost, and plant depreciation, coal depletion, investment and capital interest, risk of industry, and a reasonable profit as Secondary Cost.

It is now apparent that, at the beginning of an operation fully developed, in order that the coal in the ground should be worth 6 cents per ton, there must be a margin between the Primary Cost and the Selling Price of 46 cents per ton, divided as follows: Plant Depreciation 4, Interest on Investment 12, Coal Depletion 12, Risk of Industry 12, Net Profit 6. If this margin be narrowed by reduction of the selling price, or by increase of the Primary Cost, the inevitable result is that the coal value is lessened, while an increase in the selling price, or a reduction of the Primary Cost, increases the coal value.

The accompanying Table of Comparisons will better illustrate the effect on coal value by narrowing of margins, either by increased Primary Cost, or by reduced Selling Price.

An inspection of this table will make clear to the operator who claims that his coal has a value of 6 cents, when his Primary Cost is 73 and his Selling Price is 96, that his margin is only 23 cents and, as a result, his coal value is but 2 cents. If the operator, whose Primary Cost is 73 and Selling Price 96, paid 6 cents for his coal and says he considers a charge of 12 cents for risk of the industry and a charge of 6 cents for profit unreasonable, let him deduct 18 cents from the proper Selling Price of 116 and the remainder will be 98. He will then see that, with a Primary Cost of 73 and a Selling Price of 96, or a margin of 23 (when his Primary Cost should be but 70 and his Selling Price 98, or a margin of 28), he has suffered a direct loss of 5 cents per ton; and, sooner or later, he will meet with circumstances which will convince him that a charge for risk of the industry is justifiable and advisable at all times, whether or not the circumstances demand it at that particular time. He will also soon come to see the necessity for averting loss and to desire a reasonable profit on his investment, to accomplish which he must increase the margin 23 cents.

If an operator should be fortunate enough to escape all the risks usually present in the coal industry and the charge for risk be transferred to profit, he would simply have his profit increased to 9% on the unretired investment, which could not be considered excessive; and but few operators could ever hope to realize it. Then, when 3% profit be counted in the cost, it is possible for the profit to range from 3% to 9%.

It is apparent that, if the coal has a value of 6 cents, when the Primary Cost is 74 cents, the Selling Price must be 120 cents to give the necessary margin of 46 cents.

In compiling this table it has been assumed that as the Primary Cost lessens, because of good physical conditions, the value increases. Interest and Coal Depletion charges likewise increase, and profit and risk charges should also be increased proportionately because of the larger investment. It may at first appear that the charge for risk is increased too rapidly, but the higher priced coals come from gas producing mines, and the rate is not excessive.

The comparison of Selling Prices and other factors based on an operation having 10,000,000 tons minable coal, as shown in the upper section of table does not provide for operations of less available tonnage. The lower section of the table is designed to show a comparison for the three conditions covered by the example Indicating Method of Computing Coal Depletion.

The 25 period operation at a Selling Price of 116 is taken as a basis, has the lowest plant depreciation and gives a profit of 6 cents per ton.

The 10 period operation is charged with the same coal depletion because, conditions being uniform, the 4,000,000 tons are just as valuable as the first 4,000,000 tons of the larger acreage (which gives an average coal value of 9.75 cents), but the plant depreciation is increased because of the shorter life, and the charges for risk, interest, and profit are less because the investment is smaller, but because of the shorter life the operator must suffer loss from high rate of depreciation of Dwellings and Store, accounted for separately, and we must add to profit 4 cents to compensate for this.

The 4,800,000 tons mined from 10,000,000 tons available coal, as shown in third column, when conditions are such that the Primary Cost is 86 cents, makes operation after the twelfth period unprofitable, and plant depreciation is charged accordingly. With a 6 cent royalty, at first, and other proper charges, including an addition of 3 cents to cover high rate on Dwellings and Store, because of short life, the proper selling price is 116, and the coal value is 3.25 cents on but 4,800,000 tons. The operator who buys 10,000,000 tons of coal having physical conditions that create a Primary Cost of 86 cents, when the Selling Price is 116, can only mine 4,800,000 tons until he begins to sustain a loss of profit and, if operation be continued without an increase in selling price, he will soon sustain an actual loss, even if the coal only costs 1.56 cents.

If an operator buys 10,000,000 tons of coal at 1.56, obtains a Primary Cost of 70 and sells the product at 100 he will begin to lose his profit after mining 4,800,000 tons, on which he began charging a royalty of 6 cents, and he has made 5,200,000 tons of, otherwise valuable, coal worthless because of selling at too low prices.

A careful study of the causes and effects should convince every one that operators producing similar grades of coal must all receive about the same price for the product; that variation, of any degree, in price may obtain as between various districts producing varying grades, but not between operators of a district producing a uniform grade without the low priced operator directly depressing his own values and indirectly the values of his competitors.

From these factors, the operator can have his property, whether a new or an old one, valued by a competent engineer and determine the proper factors as a basis of calculating costs.

Chart C is designed to show, by means of an irregular curve, the relation between output and cost.

Assuming 200 days operation to represent 100% working time, and that 75c per ton covers the primary cost, it is apparent that, when the total cost is $1.10, the secondary cost is 35 cents per ton.

Three curves are shown as 1, 2, and 3. Curve 1 is designed to show increase of cost due to reduction of working time when coal depletion and risk of industry is charged by the ton. It will be observed that when the working time is reduced to 25% of 200 days the cost, as shown by curve 1, is $1.42, while at 50% working time the cost is $1.21. In other words, when the operation reduces the working time from 200 days to 100 days per year the cost increases 11 cents per ton.

Curve 2 is designed to show the increase in cost due to reduction of working time, when the coal depletion charge is considered as a fixed amount, as in a case where bonds, or preferred stock, is issued under terms requiring a minimum payment per year. It will be seen that, when the coal depletion charge is thus fixed and the working time is but 100 days, the cost increases from $1.10 to $1.33.
Curve 3 shows how the cost increases due to reduction of working time, when the risk of industry is treated as a fixed charge and the working time is but 100 days, in which instance the cost increases from $1.10 to $1.45.

In the coal mining business the maximum working time cannot be estimated at more than 300 days and, in general practice, the average working time of mines is about 200 days. This chart, which shows costs of $1.21, $1.33, and $1.45, for the conditions represented by curves 1, 2, and 3, with 50% working time, represents practically one-third the maximum possible working time.

Some operators, during certain periods, are fortunate enough to operate 200 days or more per year, while others are unfortunate enough not to be able to work nearly so much time. This uncertainty, in many cases, influences the operator to sell his product at less than cost and suffer loss, because he estimates that, by keeping his mine working, he avoids a greater loss due to increased cost per ton of maintenance and overhead, which would result from a reduction in working time.

The operator who tries to guard against loss by even temporarily selling his product at less than cost with a view of minimizing loss from increased maintenance and overhead, simply parts with a portion of his assets without compensation.

The operator, with a new operation and low Primary Cost, may think competition with the operator having an older mine an easy problem, but he overlooks the coming of another new mine at a time when his mine becomes one of the older ones.

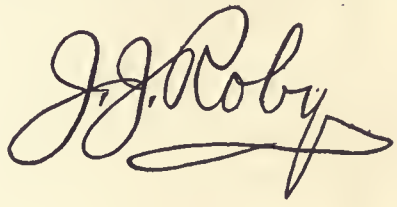
Again, the operator may contemplate a general advance, or enhancement, in the value of coal property, because of enormous production and consequent reduction of reserves, but this is more especially true of certain regions, while values in other regions remain stationary, or even decline, and enhancement is not to be depended upon, especially if the operator depresses the value by establishing a price at less than cost.

Nothing but a realization of the potent fact that the operator, to be successful, must earn sufficient during the earlier years of his operation, when his Primary Cost is least, to amortise a large part of his investment and reduce his interest charge, will save him from ultimate loss of, at least, some of his means.

The only safe course is to sell only at a price that will cover both primary and secondary costs with a reasonable profit included in the secondary cost.

By this method of accounting the operator charges all his cost and his profit into the cost of producing a ton of coal and he is not misled as by the varying and incorrect methods of cost accounting generally in use.

In conclusion, the writer would, no doubt, be considered optimistic to express the hope that Coal Operators generally will act upon the suggestions herein made, but to those who may find within these pages some helpful information let this work be dedicated.



Example Indicating Method of Computing Coal Depletion

(Based on operation until haul becomes prohibitive)

Period	Number of tons each period	Depletion rate when value is 6c on 10,000,000 tons	Amount of Depletion for period	Accumulated Depletion	Depletion rate when earning only sufficient to pay 6c royalty at beginning	Amount of Depletion for period.	Accumulated Depletion.
1	Development						
2	400,000	12.	$48,000		6.	$24,000	
3	400,000	11.5	46,000		5.5	22,000	
4	400,000	11	44,000		5.	20,000	
5	400,000	10.5	42,000		4.5	18,000	
6	400,000	10.	40,000		4.	16,000	
7	400,000	9.5	38,000		3.5	14,000	
8	400,000	9.	36,000	4,000,000 tons, value 9.75c.	3.	12,000	4,800,000 tons, value 3.25c
9	400,000	8.5	34,000		2.5	10,000	
10	400,000	8.	32,000		2.	8,000	
11	400,000	7.5	30,000	$390,000	1.5	6,000	
12	400,000	7.	28,000		1.	4,000	
13	400,000	6.5	26,000		.5	2,000	$156,000
14	400,000	6.	24,000				
15	400,000	5.5	22,000				
16	400,000	5.	20,000				
17	400,000	4.5	18,000				
18	400,000	4.	16,000				
19	400,000	3.5	14,000				
20	400,000	3.	12,000				
21	400,000	2.5	10,000				
22	400,000	2.	8,000				
23	400,000	1.5	6,000				
24	400,000	1.	4,000				
25	400,000	.5	2,000				
26	400,000			$600,000			$156,000

6,000,000 tons, value 3.5c 10,000,000 tons, value 6c	May be made valuable by an increase in carnings, but why not from the beginning.	5,200,000 tons no value. 10,000,000 tons value 1.56c

Table of Comparisons

(Based on 10,000.000 tons available and minable coal. Factors given in cents per net ton.)

Selling Price	Reasonable Profit	Risk of Industry	Coal Depletion	Investment and Capital Interest	Plant Depreciation	Primary Cost	Secondary Cost	Coal Value
86	1.50	3.00	0	3.00	4	74.50	11.50	0
91	2.25	4.50	2	4.50	4	73.75	17.25	1
96	3.00	6.00	4	6.00	4	73.00	23.00	2
101	3.75	7.50	6	7.50	4	72.25	28.75	3
106	4.50	9.00	8	9.00	4	71.50	34.50	4
111	5.25	10.50	10	10.50	4	70.75	40.25	5
116	6.00	12.00	12	12.00	4	70.00	46.00	6
121	6.75	13.50	14	13.50	4	69.25	51.75	7
126	7.50	15.00	16	15.00	4	68.50	57.50	8
131	8.25	16.50	18	16.50	4	67.75	63.25	9
136	9.00	18.00	20	18.00	4	67.00	69.00	10
146	10.50	21.00	24	21.00	4	65.50	80.50	12
156	12.00	24.00	28	24.00	4	64.00	92.00	14
166	13.50	27.00	32	27.00	4	62.50	103.50	16
176	15.00	30.00	36	30.00	4	61.00	115.00	18
186	16.50	33.00	40	33.00	4	59.50	126.50	20

Comparison as Covered by Example Indicating Method of Computing Coal Depletion

	10,000,000 Tons, 25 Per.	4,000,000 Tons, 10 Per.	4,800,000 Tons, 12 Per.	10,000,000 Tons, 12 Per.
Primary Cost	70	70.00	86.00	70.00
Plant Depreciation	4	7.875	7.65	7.65
Risk of Industry	12	8.85	5.34	5.34
Coal Depletion	12	12.00	6.00	6.00
Investment Interest	12	8.85	5.34	5.34
3% Profit	6	4.425	2.67	2.67
Added for short life and high depreciation of dwellings and store	0	4.00	3.00	3.00
Selling price	116.	116.	116.	100.

Schedule of Plant Depreciation

PROPERTY			Depreciation rate for remainder.			
DIVISION	KIND OF PROPERTY	Property subject to salvage allowance	Deduct as salvage before depreciating	Non-Fireproof	Fireproof	Remarks
Real Estate	Surfaced Land	All	30%			A.
Mining Rights	Coal in fee					B.
	Leased coal					C.
Surveys and Maps	Original Maps, Instruments and Outfits	Instruments and Outfits	10%		6	D.
General Office	Furniture and Fixtures	All	20%		6	D.
Organization	Cost of same					D.
Financing	Cost of same					E.
Railroad	Cost of same	Rail only	50%			D.
Openings and Hoists	Openings and Shafts					D.
	Ropes and Sheaves	Ropes & Sheaves	10%		25	D.
	Hoisting Engines	Hoisting Engines	15%		8	D.
Tipple Equipment	Structure	Structural steel only	20%	8	5	D.
	Equipment	Steel only	10%		10	D.
Power Plant	Building	Brick & Steel only	10%	6	4	D.
	Pipe, Heaters and Pumps	All	10%		8	D.
	Boilers and Settings	All	10%		8	D.
	Engines, Dynamos, and Switchboards	All	20%		4	D.
Shop and Equipment	Building	Brick & Steel only	10%	6	4	D.
	Equipment	All	10%		6	D.
Ventilating Equipment	Fan Housing	Brick & Steel only	10%	8	5	D.
	Fans and Drive	All	10%		8	D.
Mine Office	Building	Brick & Steel only	10%	5	4	D.
	Furniture and Fixtures	All	10%		6	D.
Storehouse	Building	Brick & Steel only	10%	6	4	D.
	Fixtures	All	10%		6	D.
Stable and Live Stock	Building	Brick & Steel only	10%	6	4	D.
	Fixtures				6	D.
	Live Stock and Harness				20	D.
Mine Tracks	Steel Rails and Splices	All	50%		4	D.
	Wood Ties				20	D.
	Steel Ties and Spikes	All	10%		10	D.
	Labor, Main Roads				25	D.
	Wood Rails				100	D.
Electric Wiring	Trolley and Feed Wire	Wire only	50%		6	D.
	Insulators, Switches, and Bonds	All	10%		10	D.
	Poles and Supports				10	D.
	Labor on Mains				10	D.

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Schedule of Plant Depreciation

PROPERTY			Depreciation rate for remainder.			
DIVISION	KIND OF PROPERTY	Property subject to salvage allowance	Deduct as salvage before depreciating	Non-Fireproof	Fireproof	Remarks
Lighting Equipment	Light Wires	All	20%		5	D.
	Fixtures and Lamps	All	10%		5	D.
Mine Locomotives	Electric Locomotives, Haulage, Engines	All	15%		8	D.
	Ropes and Sheaves	All	10%		25	D.
Mining Machines	Cutting Machines	All	10%		8	D.
Mine Cars	Wood cars	All	10%		20	D.
	Steel cars	All	15%		12	D.
Wagons and Tools	Wagons and Tools	All	10%		20	D.
Safety Appliances	Safety Appliances, Fire Extinguishers	All	10%		10	D.
Telephone Equipment	Telephones and Telephone Lines	All			10	D.
Dwellings	Dwellings	All	10%	5	4	D.
Store	Building	All	10%	5	4	D.
Lubricating Equipment	Retainers and Measure				10	D.
Steel Roof Supports	Steel	All	20%		10	D.
Mine Pumps and Pipe	Pumps and Drive	All	10%		10	D.
	Pipe	All	5%		20	D.
Stone and Dirt Equipment	Special Cars and Equipment	All	10%		20	D.

DIGEST

Coal operators lose money through improper methods of accounting.

Coal operators should charge for their product a price that will cover the cost of production and the risks of the industry, pay interest on the investment, return the investment and a reasonable profit.

Our laws protect the consumer against extortion on the part of the producer, but they do not protect the producer against the folly of his competitors.

The prudent business man demands for his product a price that will pay all cost, including interest on and return of capital, and yield to him a profit.

Because of certain hazards not present in other lines of business, the coal operator is entitled to the largest measure of profit.

Cost accounting, as applied to other lines of business, misleads the coal operator.

Coal operators mine their most valuable coal first, and they do not charge a royalty in proportion to the value of the coal mined.

The coal operator, unlike the manufacturer, must, at once, acquire sufficient raw material to operate a long period of years.

The coal operator, unlike the manufacturer, because of constant depletion of coal and of rapid depreciation of plant, cannot keep his property intact.

The value of coal property changes from various causes, and a narrowing of margins always depresses the value.

Coal operators frequently confuse themselves, in accounting, by not separating investment in rentable buildings and inoperative coal rights from investment in the coal operation.

Some operators mislead themselves and suffer loss by disregarding plant depreciation and interest on investment, and, as a result, they sell coal at prices that result in direct loss.

The method of cost accounting should enable the operator to accurately determine the cost of conducting his business, which should include a reasonable profit, and to continue the operation at a profit until all the coal is mined.

The cost of production, if properly computed, will indicate about the same selling price for coal of similar grades, regardless of ownership, magnitude of operation, probable duration of operation, and physical conditions.

Variations in total cost, if properly computed, may obtain as between producers of different districts producing various grades, but not as between producers of the same grade, consequently, the selling price should not vary more than the cost.

When the coal operator sells coal at less than cost, in order to keep his mine running, he simply disposes of a portion of his property without compensation.

When the operator sells coal at a low price, because his mine is new and his primary cost low, he suffers a loss even though he believes he is making a profit.

When the operator sells coal at less than cost, depending on an enhancement in value, he will be disappointed, because he, by his act, prevents what he is depending upon and hoping for.

The operator, to make good, must earn sufficient during the earlier years of his operation to amortize a large part of his investment and reduce his interest charge.

The only safe course is to sell coal at a price that will cover all costs, properly computed, included in which is a reasonable profit.

A tract of 10,000,000 tons of coal that cannot be mined at a Primary Cost and marketed at a Selling Price to permit an initial royalty of 12 cents cannot have an average value of 6 cents, nor can it all be mined at a profit.

The PRIMARY COST of operation is represented by actual expenditures made in the ordinary course of operating but should not include interest or payments on borrowed capital.

The SECONDARY COST of operation consists of proper charges, against the product, for plant depreciation, coal depletion, interest on investment and capital, risk of the industry, and a reasonable profit.

The proper SELLING PRICE is the sum of the PRIMARY and SECONDARY costs.

The SECONDARY COST, or margin between SELLING PRICE and PRIMARY COST, of a standard grade of coal, of the best quality and with the most favorable physical conditions, determines the basic value for coal of that grade, the value being modified as adverse physical conditions increase Primary Cost and as poorer quality reduces the Selling Price.

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